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ABSTRACT

This investigation tried to determine if a statistically significant relationship exists between different sequences of enrollment in remedial mathematics and grades obtained in college algebra classes at Jacksonville State University. Groups consisting of five different enrollment sequences in mathematics were studied. The data collected supports the following conclusions: (1) Students passing remedial mathematics before attempting college algebra made significantly higher grades in college algebra than pupils failing remedial mathematics before attempting the course: and (2) Students passing remedial mathematics before attempting college algebra made significantly higher grades in algebra than pupils who enrolled in college algebra before taking remedial mathematics but who did not attempt algebra after completing the remedial course. The report suggests that students exhibiting mathematical deficiencies should be identified and required to take remedial mathematics before enrolling in college algebra in order to avoid a possible failure experience in the latter course. It is also suggested that two different types of remedial mathematics be offered; one for pupils with serious deficiencies and the other for students who only need to "brush-up" on rusty skills. (Author/MP)

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REMEDIAL MATH AND COLLEGE ALGEBRA GRADES

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PRESENTED AT THE ANNUAL MEETING

OF THE

MID-SOUTH EDUCATIONAL RESEARCH ASSOCIATION

IN

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ABSTRACT

This investigation was to determine if a relationship existed between grades obtained in college algebra classes and five sequences of enrollment in remedial mathematics (LS110). Group one (1) consisted of twenty-three students passing LS110 before attempting college algebra. Group two (2) was composed of eight students failing LS110 before attempting college algebra. Group three (3) contained twelve students who failed college algebra before passing remedial math and then attempting college algebra again. Group four (4) was composed of fourteen students who enrolled in college algebra before taking LS110 but did not attempt college algebra after completing LS110. Group five (5) included eleven students who previously failed college algebra before attempting college algebra a second time without ever taking LS110.

Even though the significance of mathematical remediation for the disadvantaged student is national in scope, each individual institution of higher education must be individually accountable, financially as well as academically, in serving public interests and its students. Statistical evaluation facilitates the achievement of this goal.

The data support the following conclusions: 1) students passing remedial mathematics before attempting college algebra

differ significantly from students failing remedial mathematics before attempting college algebra, $p = .05$; and 2) students passing remedial mathematics before attempting college algebra differ significantly from students who enrolled in college algebra before taking remedial mathematics but did not attempt college algebra after completing remedial mathematics, $p < .05$.

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INTRODUCTION

At the Center for Individualized Instruction at Jacksonville State University, a remedial mathematics course (LS110) is available for students exhibiting a weak background in high school mathematics. This course, which has been offered each semester since the Spring of 1978, is intended to remediate basic skill deficits in order to facilitate successful performance in College Algebra (Math 101).

STATEMENT OF THE PROBLEM

The essence of the problem was to determine if a statistically significant relationship at the .05 level exists between different sequences of enrollment in remedial math (Independent Variable) and grades obtained in the University's college algebra classes (Dependent Variable). Statistical significance was determined by calculating the grades with an A, B, C, D and F equivalent to a 4, 3, 2, 1 and 0, respectively.

Groups based on five sequences of enrollment in remedial math and College Algebra were formed.

Experimental Groups

Group 1: Twenty-three students who passed remedial math before attempting college algebra.

Group 2: Eight students who failed remedial math before attempting college algebra.

Group 3: Twelve students who failed college algebra before passing remedial math and then attempted college algebra again.

Control Groups

Group 4: Fourteen students who enrolled in college algebra before taking remedial math and did not attempt college algebra after completing remedial math.

Group 5: Eleven students who failed college algebra before attempting college algebra a second time and never took remedial math.

SIGNIFICANCE OF THE PROBLEM

The problem of dealing effectively with the educationally disadvantaged student extends beyond Jacksonville State University; its significance is a national concern. Many writers have concluded there is an increase in this type of student due to open enrollment admission policies. Gaonkar, Douglas, and Krishnan (1977), Utz (1973), and Partee and Halsey (1977) among others have recognized this trend. Additional evidence of the growth of the phenomenon known as the educationally disadvantaged student is given by Myers (1979), who expresses concern regarding the decline of SAT scores.

Several different strategies have been proposed to deal with the inadequately prepared student. Watkins (1980) reports that the Carnegie Foundation for the Advancement of Teaching is planning a two-year study to investigate the relationship between secondary education and higher education in order to learn what can be done to resolve the problem of inadequately prepared students. However, another approach that has gained

wide acceptance nationally has been the implementation of remedial courses within the college or university environment. Bittinger (1972) described several approaches to teaching remedial math and points out the pros and cons of each. The views are based on the experience and reactions of students and instructors at the college level. In conclusion, he states that their applicability may depend on different students, instructors, and schools. However, no statistical evaluation of the different approaches is presented. Brown (1971) also in referring to the remedial program at Federal City College of Washington, D.C. does not mention the criteria or the process to evaluate the effects of remediation. Gaonkar, Douglas, and Krishnan (1977) in referring to the Bittinger (1972) article stress the need for statistical evaluation in order to ascertain the effectiveness of the different approaches. Therefore, the Gaonkar, Douglas, and Krishnan (1977) article stressing evaluative statistics in combination with the conclusion reached by Bittinger (1972) that the applicability of various approaches may depend on the uniqueness of the students, instructors, and schools involved provide support for the rationale of employing institutional research involving statistical evaluation.

Yet a limited review of the literature indicates there are several remedial math programs in addition to those previously mentioned that do not provide either data and/or

a statistical evaluation of the data generated from the programs. Watman (1972), Lederman (1977), McDonald (1972) and Partee and Halsey (1977) among others fall in this category. Several additional writers (Watman, 1972; Dahlke, 1975; Hill, 1978) also encourage research on remedial programs. For instance, Hill (1978) not only stresses the importance of research on math remediation but also the type of research that should be conducted. In his article he indicates the confusion which exists regarding the procedures and methodologies suitable for remediating or correcting deficits as well as the lack of data supporting viable programs. Hill (1978) further concludes a major weakness of most programs has been their inability to evaluate. However, in response to the criticisms for more and better research designs, he reminds his readers that colleges and universities are dealing with human beings, not animals, in the laboratory setting. Therefore, the type of controls necessary for valid research are simply inappropriate in the higher education environment. For example, is it justifiable to deny access of a high-risk student to an experimental program because he or she was not randomly selected? Yet he still maintains that it is of paramount importance for the continued support for such programs to validate the success of different remedial procedures. A primary issue of any investigation regarding remediation is to determine how well students in the developmental program perform in

college level course work, not how well they achieve in a remedial course. A review of the literature did indicate the evaluation of remedial math programs; however, few of these investigations fulfilled the criteria as established by Hill (1978).

Edwards (1972) for instance conducted a study to predict success in remedial math courses at the junior college level. Using the Multiple Regression Statistical model he concluded that success in remedial math courses could be predicted correctly 71% of the time by using five select predictors. Several other studies regarding the evaluation of remedial math programs investigated how well students succeeded in only the remedial course and not the subsequent college level math course. O'Tuel (1974) and Pepper (1978) among others also fall in this category. Some articles did relate remedial math performance to success in subsequent college level math course work. Webster (1976), Sparks and Davis (1977), and Thompson (1979) exemplify this evaluative approach.

For instance, Sparks and Davis (1977) in evaluating the effectiveness of the Special Studies program at Dalton Junior College (Georgia) on performance in college credit courses made a comparison of the grades earned by former Special Studies students and regular (non-Special Studies) students in the same classes. The results indicated that out of 260 former Special Studies students and 521 regular

students, 61.2% and 55.9% respectively made a "D" or better grade in a college level math course. These investigators point out that since all students at their Junior College whose SAT and CGP test scores fall below the cut-off levels are required to enroll in the appropriate Special Studies Course(s), there was no appropriate control group from the student body for this math evaluation. Therefore, in order to determine if Special Studies students would have performed at the same levels without participation in the program, mean grade point averages of former Special Studies students and regular students enrolled in English 101 classes were correlated with their initial Comparative Guidance and Placement test scores. Also, a line of best fit was calculated which indicated that former Special Studies students' scores deviated more than the regular students and generally the former Special Studies students' scores were above the regression line. Sparks and Davis (1977) conclude this analysis of the data indicates former Special Studies students perform at a higher level than their entry scores on the CGP test would indicate. However, it should be noted that Sparks and Davis (1977) did not correlate a specific CGP test math score with a specific college level math grade. Therefore one must maintain caution when generalizing their results from the general grade point average specifically to performance in college level math courses.

Another concern that emerges in the evaluation of remedial programs is cost accountability. Gemignani (1977) reports that Indiana University--Purdue University--Indianapolis, while not having an open admission policy experienced a rapid increase in the number of students seeking remedial courses equivalent to first and second high school algebra. Whereas only 1 or 2 sections were necessary in 1972-73, 6 sections a semester barely met this need in 1975-76. Since funds were limited, larger sections of Math 111 (second year high school algebra) were added. Using Chi-square it was reported that the data supported the hypothesis that larger class size resulted in a significantly higher failure rate ($p < .001$). Assuming that class size was the critical element in differences between the success rates of the 1972-1973 and 1975-1976 remedial groups even though other data indicated the 1975-1976 class exhibited more deficits, Gemignani (1977) reports it would have been necessary to double the expense to increase the number for successful students by one-third. He, therefore, concludes by stating that funds must be used in areas where the return is greatest. Furthermore, the author states that neither society, the institution, nor the student benefits by diverting funds to remedial programs intended for other higher education programs.

In contrast to this view, Utz (1972) states in describing the Single Concept Introductory Mathematics Project (SCIMP)

at Kingsborough Community College at Manhattan Beach, Brooklyn, that even though the SCIMP program is more expensive than a standard classroom to operate, it should be maintained because fewer students fail the SCIMP course than the traditional course. Hill (1978) indicates that even though no college program has been highly successful in its efforts to remediate educational deficiencies, most studies reveal remediation is expensive. As an example he states that the developmental program at North Campus of Florida Junior College costs 80% more than regular college courses. Hill (1978), therefore, concludes that the tighter financial situations that most colleges and universities are experiencing as well as pressure for cost accountability from government officials increase the need for the evaluation of program results. Furthermore, he emphasizes that unless institutional research is generated to determine the viable parts of remedial programs and unless higher educational institutions remove the malfunctioning aspects of their programs, all remediational efforts will be subject to extinction.

EVALUATION STRATEGY

Before actually using the one-way analysis of variance model one must consider the assumptions of this statistical procedure as it relates to this investigation. One of the main assumptions that this model makes is that the subjects are randomly assigned to different groups before applying

different treatments. However, for reasons which Hill (1978) previously noted, random assignment as an aspect of design control could not be implemented. Since students were assigned to groups based on a characteristic which was their remedial math/college algebra enrollment history, the random sampling assumption is questionable. In other words, students were assigned to different groups after determining their remedial math/college algebra enrollment patterns. Therefore, it is possible that the difference in mean college algebra grades was not caused by the sequence of their enrollment in remedial math, but is dependent on group classification.

Analysis of variance also assumes that the population from which the samples were drawn is normally distributed. This particular assumption cannot be directly tested; however, any violations of the assumption are manifested in violations of the third assumption, homogeneity of population variance. Therefore, before proceeding to run analysis of variance it was necessary to test the assumption of homogeneity of population variance. The following null and research hypotheses were established to conduct this test.

Null Hypothesis

The population variances of the five different groups are equal to each other.

Research Hypothesis

At least one of the population variances of the five different groups differs from the other variances.

Hartley's Fmax formula was selected as the test statistic to test the null hypothesis in which the ratio between the largest sample variance to the smallest sample variance of the five different groups was examined.

$$Fmax = \frac{S^2 largest}{S^2 smallest}$$

The null hypothesis would be rejected ($\alpha = .05$) if the calculated Fmax value is equal to or greater than 3.54, which is the critical Fmax value with 5 and 20 degrees of freedom. (Please note that since the available Fmax table contained 20 rather than 22 degrees of freedom, 20 degrees of freedom were used to calculate critical Fmax). After collecting the necessary data, the Fmax test was run to test the homogeneity-of-variance assumption (see Table 1).

TABLE 1

BASIC STATISTICAL SUMMARY TABLE

GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
GRP01	23	1.2609	1.2142	0.2532	0.0	3.0000	0.7358 to 1.7859
GRP02	8	0.0	0.0	0.0	0.0	0.0	0.0 to 0.0
GRP03	12	1.0000	1.1282	0.3257	0.0	3.0000	0.2832 to 1.7168
GRP04	14	0.0714	0.2673	0.0714	0.0	1.0000	-0.0829 to 0.2257
GRP05	11	0.7273	0.9045	0.2727	0.0	2.0000	0.1196 to 1.3349
TOTAL	68	0.7353	1.0455	0.1268	0.0	3.0000	0.4822 to 0.9884

The resulting calculated Fmax value is 20.64. Therefore, the null hypothesis is rejected with a 95% level of confidence, which indicates that the homogeneity of population variance assumption is violated. This violation indicates that if one-way analysis of variance were used to examine the differences between the 5 groups, then the results would be questionable. Since non-parametric techniques do not make the homogeneity of population variance assumption, they were selected to analyze the data making all pair-wise comparison if overall significance were established. Thus the following null hypothesis and research hypothesis were formulated.

Null Hypothesis

The 5 populations from which the samples were selected are the same.

Research Hypothesis

At least one of the populations from which the samples were drawn is different from other populations.

The Kruskal-Wallis non-parametric statistical technique was selected as the test statistic to test the previously mentioned null hypothesis.

$$H = \frac{12}{N(N+1)} \cdot \Sigma \frac{R^2}{n} - 3(N+1)$$

If ties occurred, then H is to be divided by

$$\frac{1 - \Sigma Ti}{N(N^2-1)}$$

in which $Ti = (ti-1)(ti)(ti+1)$

and ti = number of observations tied at a rank.

The null hypothesis would be rejected [$X^2(.05)$] with 4 degrees of freedom if the calculated H-test value after corrections for ties is equal to or greater than critical H-test value of 9.49. Then the one-way analysis of variance Kruskal-Wallis H-test was run. The resulting calculated H-test value after correcting for ties is 17.0 (see Table 2 for additional information).

TABLE 2

KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE TABLE

GROUP	1	2	3	4	5
NUMBER	23	8	12	14	11
MEAN RANKS	43.02	21.50	38.92	23.29	35.59

			CORRECTED FOR TIES	
CASES	CHI-SQUARE	SIGNIFICANCE	CHI-SQUARE	SIGNIFICANCE
68	12.865	0.012	17.000	0.002

Therefore, the null hypothesis is rejected with a 95% level of confidence which indicates that at least one of the populations from which the 5 groups were drawn is different from the other populations. At this point in the analysis it is not possible to state which group or groups differ from the other groups.

The Mann-Whitney U-test was selected as the follow-up procedure to determine which group or groups differed from

the other groups. Since the Mann-Whitney U-test can only make pair-wise comparisons and also tends to inflate the hypothesis-wise error rate, the following formulas were used to determine the hypothesis-wise error rate for each pair-wise comparison in order to maintain an overall experiment-wise error rate at the .05 level.

$$\alpha(H\text{-}W) = \frac{\alpha(E\text{-}W)}{C} \qquad C = \frac{K(K-1)}{2}$$

The resulting hypothesis-wise error rate (α(H-W) for each pair-wise comparison in order to maintain an overall experiment-wise error rate α(E-W) at the .05 level) is .005. Then the Mann-Whitney U-test was run (see Table 3).

CONCLUSIONS

The data support the following conclusions: 1) students passing remedial mathematics before attempting college algebra (Group 1) made significantly higher grades in college algebra than students failing remedial mathematics before attempting college algebra (Group 2); $p = .05$; and 2) students passing remedial mathematics before attempting college algebra (Group 1) made significantly higher grades in college algebra than students who enrolled in college algebra before taking remedial mathematics but did not attempt college algebra after completing remedial mathematics, $p < .05$.

DISCUSSION

Loree (1970), in referring to Lachman's five operating

TABLE 3

MANN-WHITNEY FOLLOW-UP TABLE ON PAIR-WISE COMPARISONS

GROUPS	MEAN RANK	NUMBER	U	Z	2 TAILED P
1	22.98	23	69.5	-3.238	.001*
4	12.46	14			
1	18.43	23	36.0	-2.783	.005*
2	9.00	8			
3	16.71	12	45.5	-2.543	.011
4	10.75	14			
2	7.50	8	24.0	-2.296	.022
3	12.50	12			
4	10.79	14	46.0	-2.271	.023
5	15.82	11			
2	7.50	8	24.0	-2.1383	.033
5	11.82	11			
1	18.85	23	95.5	-1.208	.227
5	14.68	11			
2	11.00	8	52.0	- .756	.450
4	11.79	14			
1	18.76	23	120.5	- .642	.521
3	16.54	12			
3	12.67	12	58.0	- .541	.589
5	11.27	11			

*$p \leq .05$

concepts of science, emphasizes that one must maintain caution, objectivity, and a degree of skepticism in the interpretation of conclusions which result from any scientific endeavor. For instance, even though both means for the experimental groups that passed remedial math are higher than the experimental group that failed remedial math and the control groups, they were not statistically significant at the .05 level in most instances.

Since students passing remedial math before attempting college algebra (Group 1) made significantly higher grades in college algebra than students failing remedial math before attempting college algebra (Group 2), $p = .05$, there is some support for the idea that students acquiring the necessary math skills to pass remedial math have a much greater probability of passing college algebra than do students who do not have the math skills to pass remedial math. However, even this conclusion must be maintained cautiously since there was not total support of this idea. For instance, students previously failing college algebra before passing remedial math and then attempting college algebra again (Group 3) did not make statistically significant higher grades in college algebra than students failing remedial math before attempting college algebra (Group 2), $p > .05$.

The previous discussion is also suggestive of the idea that students exhibiting math deficits should be identified

and required to take remedial math before enrolling in college algebra in order to avoid a possible failure experience in the college course. Failure might reduce the possibility of success in algebra after acquiring the necessary math skills. A similar inference might be drawn from the following analysis of the data: students of Group 1, those who passed remedial math before attempting college algebra, made significantly higher algebra grades than did the students of Group 4, those students who entered remedial math after college algebra, while later electing not to repeat college algebra, $p < .05$.

Yet, it is also important to maintain a degree of skepticism about the effects of a failure experience because Group 1 students, those passing remedial math before attempting college algebra, did not make algebra grades which were higher to a statistically significant degree than did students of Group 5, students who failed college algebra before attempting it a second time, and who never took remedial math, $p > .05$. If the previously mentioned pair-wise comparison had been statistically significant, it would have provided strong support for the effectiveness of the remedial math course. An even stronger indication of the effectiveness of the remedial math course in relation to college algebra grades would be demonstrated if students previously failing college algebra before passing remedial math and then attempting college

algebra again (Group 3) had made statistically significant higher grades in algebra than students who previously failed college algebra before attempting college algebra a second time who never took remedial math (Group 5); yet, evidence of this result was not revealed, $p > .05$. Even though a statistically significant difference at the .05 level is lacking, the data are suggestive of the idea that students who enrolled in college algebra and later enrolled in remedial math (Group 4) exhibited more serious deficits in math than students who previously failed college algebra before attempting college algebra a second time who never took remedial math (Group 5) (see Table 4). This indication of degree of math deficiency is also revealed by Dahlke (1975) and Gaonkar, Douglas and Krishnan (1977).

Therefore, the educators responsible for construction of remedial math might want to consider offering two types of remedial math courses; 1) one course for students exhibiting serious deficits in math and 2) another course for students who need only to "brush up" on rusty skills. Another alternative for building a stronger relationship between passing remedial math and success in college algebra classes would be to select students who can benefit most from the remedial math course by using a predictive method as suggested by Edwards (1972).

TABLE 4

SUMMARY TABLE OF GROUPS

	GROUPS		DEPENDENT VARIABLE	GROUP NUMBER
	Math Courses	LS110**	Grade obtained by student A=4 C=2 F=0 for Math 101 B=3 D=1	Number per Group
EXPERIMENTAL	Math 101* course(s) not previously taken	Pass	0 1 2 1 0 0 0 0 0 2 0 1 3 2 2 3 3 3 0 1 2 3 0	1 n = 23
EXPERIMENTAL	Math 101 course(s) not previously taken	Failure	0 0 0 0 0 0 0 0	2 n = 8
EXPERIMENTAL	Math 101 course(s) previously failed	Pass	1 2 0 0 2 3 2 0 0 2 0 0	3 n = 12
CONTROL	Math 101 course(s) not previously taken	Taken after Math 101 Course	0 0 0 0 0 0 0 0 0 0 0 1 0 0	4 n = 14
CONTROL	Math 101 Course previously failed	Not taken; LS101 or LS105 Students ***	0 0 1 0 2 2 0 1 0 2 0	5 n = 11

*College Algebra
**Remedial Math
***Only Students enrolled in other courses at the Center for Individualized Instruction such as academic survival skills (LS101) and remedial English (LS105), but who never enrolled in remedial math (LS110).

Another suggestion to enhance the effectiveness of this remedial math course as well as other courses offered by the Center for Individualized Instruction is to provide therapy for students by utilizing either the services of the Counseling Center or the Psychology Department in conjunction with the academic remediation presently offered. Watman (1972) and Purkey (1970) emphasize the relationship between low achievement and low self-esteem. Numerous writers suggest that academic achievement is also promoted by enhancing self-esteem.

A primary issue addressed by this paper, thus far, has been statistical significance. Yet, a concern of equal importance is educational or practical significance. It is important to note that both groups (1 and 3) which passed remedial math had passing averages in college algebra; however, the group failing remedial math (Group 2) as well as both control groups had failing averages in college algebra (see Table 1). Therefore, the Center for Individualized Instruction's remedial math course has fulfilled, thus far, the goal for which it was created.

Even though there are some individuals who would question the replication of the results because statistical significance at the 95% level of confidence is lacking in several instances, it is important to note that some statistical significance at the 95% level of confidence is established in conjunction

with educational significance. Attention also needs to be given to the fact that in following traditional practice for computing grade point averages, the scale used in calculating the group means in the present study assumes an equal distance between successive grades. In other words, the difference between an "F" and a "D" is given the same importance as the difference between a "D" and a "C". The reasonableness of assuming equal importance may be questionable. It should be noted that Johnston and Simon (1976) question the traditional system of grading. Since a student receiving an "F" grade is required to repeat the course whereas another student receiving a "D" or higher grade is not required to retake algebra, the consequences of failure are more severe. It may be more appropriate to use a binary model with F = 0 and any other grade = 1. Since the Jacksonville State University Faculty Handbook states that an A, B, C, D and F are equivalent to 100% to 90%, 89% to 80%, 79% to 70%, 69% to 60%, and 59% to 0%, respectively, another possibility would be to use the midpoints of each interval to compute the class means for the Dependent Variable, or a scale where an "A" = 95, "B" = 85, "C" = 75, "D" = 65, and "F" = 30. Using these values, it is certainly possible that the non-significant differences could be statistically significant and thereby provide the basis for additional research.

These conclusions are drawn by utilizing the evaluative criteria established by Hill (1978). As the review of literature has shown many college and university centers providing remediation have not maintained the standards set forth by Hill. Until uniform maintenance of criteria for remedial math instruction takes place, it can be reasonably argued that the Center for Individualized Instruction at Jacksonville State University is as justified in continuing its remedial math program as any of the programs cited in this study.

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APPENDIX A

Example of Student Academic Advisement Sheet

05/16/80 A C A D E M I C A D V I S E M E N T D A T A S H E E T

RECORD IS COMPLETE ADMISS STATUS IS CLEAR ACADEMIC STANDN IS TEMPORARILY D

FR EXPECT TO GRAD? UNKNOWN APPLIED FOR DEGREE? NO CLR

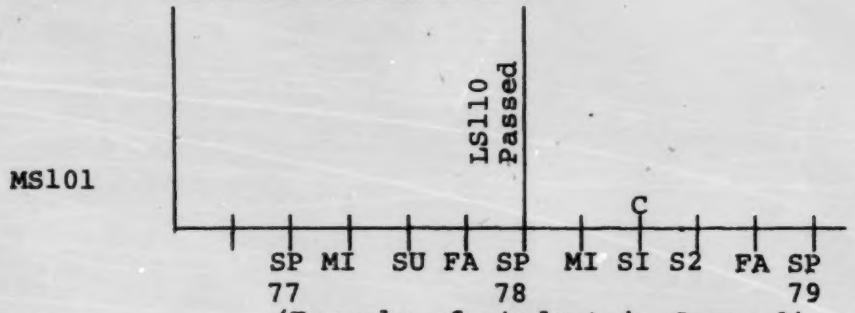
			HRS ATT	HRS ERN	QL PTS	QPA (HRS ATT
DEGREE	B. SCIENCE	U-GRADUATE	49.00	20.00	19.00	QPA (HRS ERN)
MAJOR1	NO MAJOR	GRADUATE	0.00	0.00	0.00	EXCESS TRAN
MINOR1	NO MINOR	WORK AT JSU	49.00	20.00	19.00	NON TRAD
MAJOR2	NO MAJOR	TRANSFER	0.00	0.00	0.00	300-400 LEVEL
MINOR2	NO MINOR					

SCH	DEP	CR #	COURSE TITLE	H ATT	GR	H ERN	Q PTS	LOC TM YR	SCH	DEP	CR #
			--NON TRANSFER-CRS--								
CSM	BY	102	GENERAL BIOLOGY	4.00	F	0.00	0.00	JSU FA 79			
			---DEPT SUB TOTALS--	4.00		0.00	0.00	GPA=0.000			
HSS	EH	101	ENGLISH COMPOSITION	3.00	D	3.00	0.00	JSU FA 78			
HSS	EH	102	ENGLISH COMPOSITION	3.00	F	0.00	0.00	JSU SP 80			
HSS	EH	202	AMERICAN LITERATURE	3.00	F	0.00	0.00	JSU SP 79			
*HSS	EH	202	AMERICAN LITERATURE	3.00	F	0.00	0.00	JSU FA 79			
			---DEPT SUB TOTALS--	12.00		3.00	0.00	GPA=0.000			
CSM	GY	110	PHYSICAL GEOGRAPHY	4.00	F	0.00	0.00	JSU SP 79			
			---DEPT SUB TOTALS--	4.00		0.00	0.00	GPA=0.000			
HSS	HY	201	AMERICAN HISTORY	3.00	C	3.00	3.00	JSU FA 78			
HSS	HY	202	AMERICAN HISTORY	3.00	C	3.00	3.00	JSU SP 79			
			---DEPT SUB TOTALS--	6.00		6.00	6.00	GPA=1.000			
LCI	IM	101	ORIENT TO INST MEDIA	1.00	C	1.00	1.00	JSU SP 79			
			---DEPT SUB TOTALS--	1.00		1.00	1.00	GPA=1.000			
VPA	LS	110	REINFORC QUANT SKILL	3.00	F	0.00	0.00	JSU SP 80			
			---DEPT SUB TOTALS--	3.00		0.00	0.00	GPA=0.000			
CSM	MS	101	COLLEGE ALGEBRA	3.00	F	0.00	0.00	JSU SP 79			
			---DEPT SUB TOTALS--	3.00		0.00	0.00	GPA=0.000			
VPA	MSC	115	FIRST AID	2.00	A	2.00	6.00	JSU SP 80			
VPA	MSC	116	HAND-TO-HAND COMBAT	2.00	A	2.00	6.00	JSU SP 80			
			---DEPT SUB TOTALS--	4.00		4.00	12.00	GPA=3.000			
HSS	PSC	201	GOVERNMENT OF US	3.00	D	3.00	0.00	JSU MI 79			
HSS	PSC	202	GOVERNMENT OF US	3.00	F	0.00	0.00	JSU FA 79			
			---DEPT SUB TOTALS--	6.00		3.00	0.00	GPA=0.000			
HSS	PSY	201	PRIN OF PSYCHOLOGY	3.00	D	3.00	0.00	JSU FA 78			
			---DEPT SUB TOTALS--	3.00		3.00	0.00	GPA=0.000			
HSS	SY	221	INTRO TO SOCIOLOGY	3.00	F	0.00	0.00	JSU SP 80			
			---DEPT SUB TOTALS--	3.00		0.00	0.00	GPA=0.000			
			-NON TRANSFER TOTALS	49.00		20.00	19.00				

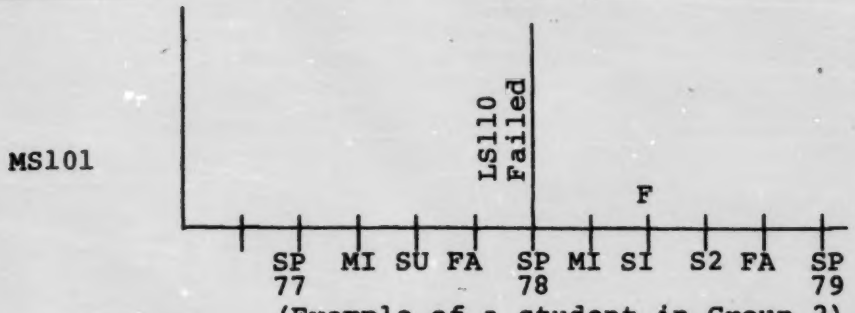
APPENDIX B

Example of Student Grade Record Sheets
(Groups 1-5)

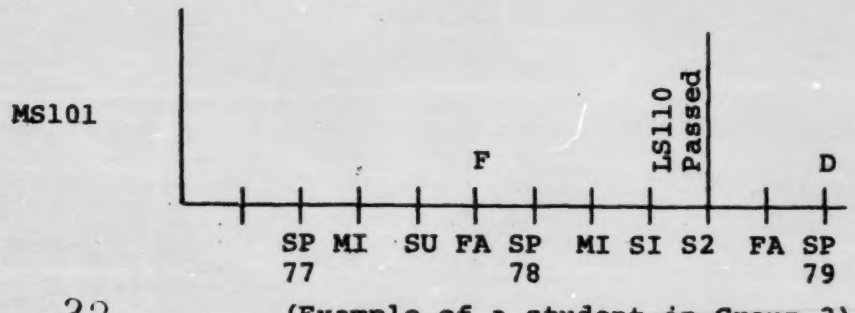
EXPERIMENTAL GROUPS



(Example of student in Group 1)

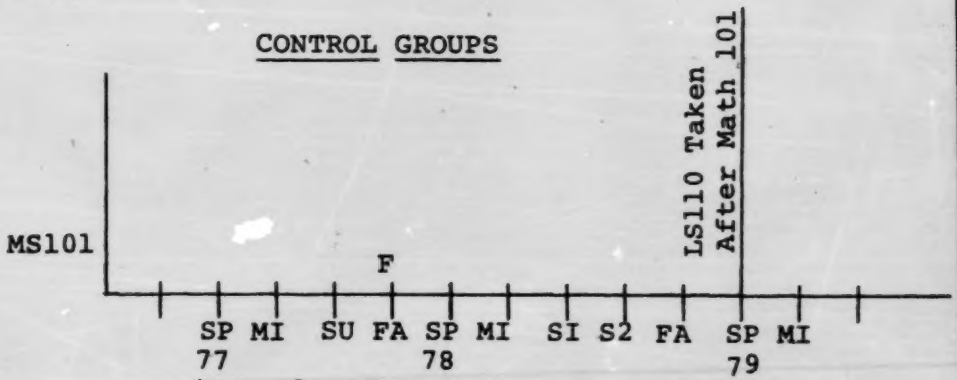


(Example of a student in Group 2)

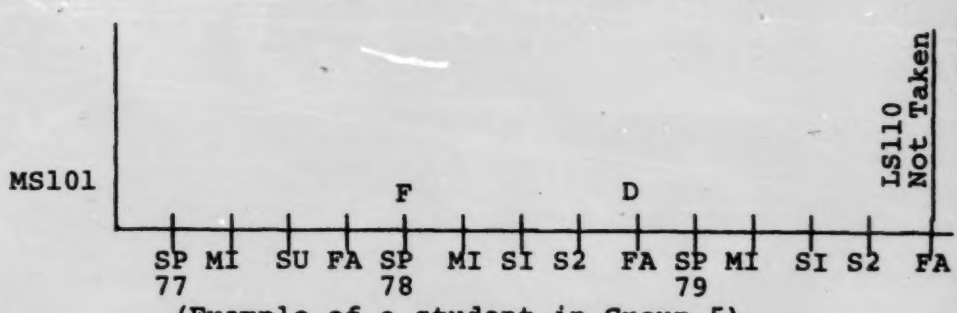


(Example of student in Group 3)

CONTROL GROUPS



(Example of a student in Group 4)



(Example of a student in Group 5)